

Underwater Vehicle Localisation using Extended Kalman Filter

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Abstract—In order to accomplish various missions, autonomous underwater vehicles need to be capable of estimating their position within the environment. This is a prerequisite of a successful mission since further tasks that need to be achieved strongly rely on navigation information. This paper presents the application of an algorithm that would accomplish the localisation of the Ocean Systems Lab's Nessie underwater vehicle using measurements from a number of sensors mounted on it. Well known Extended Kalman Filter (EKF) algorithm approach was suggested as a solution for robot self-localisation.

This paper presents a vision-based localization approach for an underwater robot in a structured environment. The system is based on a coded pattern placed on the bottom of a water tank and an onboard down looking camera. Main features are, absolute and map-based localization, landmark detection and tracking, and real-time computation (12.5 Hz). The proposed system provides three-dimensional position and orientation of the vehicle along with its velocity. Accuracy of the drift-free estimates is very high, allowing them to be used as feedback measures of a velocity-based low-level controller. The paper details the localization algorithm, by showing some graphical results, and the accuracy of the system.

I. INTRODUCTION

Your goal is to simulate, as closely as possible, the usual appearance of typeset papers. This document provides an example of the desired layout and contains information regarding desktop publishing format, type sizes, and type faces.

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If you have desktop publishing facilities, (the use of a computer to aid in the assembly of words and illustrations on pages) prepare your CR paper in full-size format, on paper 21.6 x 27.9 cm (8.5 x 11 in or 51 x 66 picas). It must be output on a printer (e.g., laser printer) having 300 dots/in, or better, resolution. Lesser quality printers, such as dot matrix printers, are not acceptable, as the manuscript will not reproduce the desired quality.

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TABLE I
AN EXAMPLE OF A TABLE

One	Two
Three	Four

Roman, or Dutch. If these are not available to you, use the closest typeface you can. The minimum typesize for the body of the text is 10 point. The minimum size for applications like table captions, footnotes, and text subscripts is 8 point. As an aid in gauging type size, 1 point is about 0.35 mm (1/72in). Examples are as follows:

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II. UNITS

Metric units are preferred for use in IEEE publications in light of their international readership and the inherent convenience of these units in many fields. In particular, the use of the International System of Units (SI Units) is advocated. This system includes a subsystem the MKSA units, which are based on the meter, kilogram, second, and ampere. British units may be used as secondary units (in parenthesis). An exception is when British units are used as identifiers in trade, such as, 3.5 inch disk drive.

III. ADDITIONAL REQUIREMENTS

A. Figures and Tables

Position figures and tables at the tops and bottoms of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table captions should be above the tables. Avoid placing figures and tables before their first mention in the text. Use the abbreviation "Fig. 1", even at the beginning of a sentence. Figure axis labels

are often a source of confusion. Try to use words rather than symbols. As an example write the quantity “Inductance”, or “Inductance L”, not just. Put units in parentheses. Do not label axes only with units. In the example, write “Inductance (mH)”, or “Inductance L (mH)”, not just “mH”. Do not label axes with the ratio of quantities and units. For example, write “Temperature (K)”, not “Temperature/K”.

B. Numbering

Number reference citations consecutively in square brackets [?]. The sentence punctuation follows the brackets [?]. Refer simply to the reference number, as in [?]. Do not use “ref. [?]” or “reference [?]”. Number footnotes separately in superscripts¹. Place the actual footnote at the bottom of the column in which it is cited. Do not put footnotes in the reference list. Use letters for table footnotes (see Table I).

C. Abbreviations and Acronyms

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, CGS, ac, dc, and rms do not have to be defined. Do not use abbreviations in the title unless they are unavoidable.

D. Equations

Number equations consecutively with equation numbers in parentheses flush with the right margin, as in (1). To make your equations more compact you may use the solidus (/), the exp. function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use a long dash rather than hyphen for a minus sign. Use parentheses to avoid ambiguities in the denominator. Punctuate equations with commas or periods when they are part of a sentence:

$$\Gamma_2 a^2 + \Gamma_3 a^3 + \Gamma_4 a^4 + \dots = \lambda \Lambda(x),$$

where λ is an auxiliary parameter.

Be sure that the symbols in your equation have been defined before the equation appears or immediately following. Use “(1),” not “Eq. (1)” or “Equation (1),” except at the beginning of a sentence: “Equation (1) is ...”.

Fig. 1. Inductance of oscillation winding on amorphous magnetic core versus DC bias magnetic field

¹This is a footnote

IV. CONCLUSIONS AND FUTURE WORKS

A. Conclusions

This is a repeat. Position figures and tables at the tops and bottoms of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table captions should be above the tables. Avoid placing figures and tables before their first mention in the text. Use the abbreviation “Fig. 1”, even at the beginning of a sentence. Figure axis labels are often a source of confusion. Try to use words rather than symbols. As an example write the quantity “Inductance”, or “Inductance L”, not just. Put units in parentheses. Do not label axes only with units. In the example, write “Inductance (mH)”, or “Inductance L (mH)”, not just “mH”. Do not label axes with the ratio of quantities and units. For example, write “Temperature (K)”, not “Temperature/K”.

B. Future Works

This is a repeat. Position figures and tables at the tops and bottoms of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table captions should be above the tables. Avoid placing figures and tables before their first mention in the text. Use the abbreviation “Fig. 1”, even at the beginning of a sentence. Figure axis labels are often a source of confusion. Try to use words rather than symbols. As an example write the quantity “Inductance”, or “Inductance L”, not just. Put units in parentheses. Do not label axes only with units. In the example, write “Inductance (mH)”, or “Inductance L (mH)”, not just “mH”. Do not label axes with the ratio of quantities and units. For example, write “Temperature (K)”, not “Temperature/K”.

V. ACKNOWLEDGMENTS

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REFERENCES